

REMARKS/ARGUMENTS

In response to the Office Action dated July 13, 2005 the applicants have amended Claim 1 and cancelled (without prejudice) Claims 15-28. Also Claims 29-35 have been added. Entry of the above amendments and reconsideration of the application in light of the amendments and comments made herein is requested.

Objections to the Specification:

The Specification has been objected to for having certain informalities. Both paragraphs [0027] and [0032] have been amended to correct certain typographic errors. Accordingly, the applicants believe that these corrections should be sufficient to address the Examiners objection to the Specification. The Applicants are willing to make further amendments should the Examiner deem it necessary. Accordingly, the Applicants request that the pending objection to the Specification be withdrawn.

Rejection of the Claims Under 35 U.S.C. § 102:

All Claims have been rejected as anticipated by a number of different references. In response, Claim 1 has been cancelled and Claim 2 has been amended to incorporate the limitations of rejected base Claim 1. No substantial change in scope is occasioned by the amendment to Claim 2. Moreover, Claim 2 is not amended to overcome any of the cited art. Therefore, the applicants respectfully submit that the scope of Claim 2 is unchanged and is for all relevant purposes unamended. The rejections of remaining Claims 2-14 are respectfully traversed. A detailed explanation of this traversal is explained in detail below.

Bunyan

Claims 1-4 and 9 are rejected under 35 U.S.C. § 102 as being anticipated by *Bunyan* (USPN 6,432,497 hereinafter "*Bunyan*"). As to Claim 1, this ground of rejection is made moot by the cancellation of Claim 1.

As to Claim 2, this claims has been amended to incorporate all limitations of Claim 1. The applicants point out that Claim 2 is distinct from *Bunyan* on several grounds. For example, Claim 2 recites a multi-layer heat transfer element having:

"a core spacer element having a top surface and a bottom surface;
a first layer of thermally conductive reflowable material formed on the top surface; and
a second layer of thermally conductive reflowable material formed on the bottom surface".

This is different from *Bunyan* which requires a double sided interface that requires pressure sensitive adhesive (PSA) to adhere the heatspreader 24 to a die 12 (See, *Bunyan* at 6:34-7:4; 9:30-35; and elsewhere). In particular, the PSA layers 36 and 38 are not the same as the reflow materials taught by the present invention. In *Bunyan*, significant processing time, effort, and money are lost preparing the devices for pressure treatment to adhere the die to the heatsink. The claimed invention dispenses with all of this wasted time and effort. In fact, in some embodiments, die attach, stiffener mounting, and heat sink attachment can be accomplished all in one reflow step. This is not possible using the *Bunyan* technology. Moreover, the *Bunyan* technology creates thick thermal layers between the die and heatspreader relative to the claimed invention thereby increasing overall package thickness. This is another undesirable attribute of the prior art.

Accordingly, for at least this reason, the applicants have shown that the cited art is missing certain claimed elements (i.e., the reflowable first and second layers) and is therefore insufficient to establish a *prima facie* case of anticipation relative to Claim 2. As a consequence, the applicants request that this ground of rejection be withdrawn and Claim 2 be allowed.

Moreover, as to dependent Claims 3-14, all of these claims are dependent on Claim 2. Each of these claims has separate grounds for allowance. However, due to the failure to establish a *prima facie* case of anticipation of base claim 2 it is not necessary to discuss the details of the dependent claims at this time.

Chen

Claims 1, 2, 4, 5, 7, 8, 10, and 11 are rejected under 35 U.S.C. § 102 as being anticipated by *Chen et al.* (USPN 6,716,676 hereinafter "*Chen*"). As to Claim 1, this ground of rejection is made moot by the cancellation of Claim 1.

As to Claim 2, this claims has been amended to incorporate all limitations of Claim 1. The applicants point out that Claim 2 is distinct from *Chen* on several grounds.

For example, Claim 2 recites a "multi-layer heat transfer element arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader".

Also, Claim 2 recites a multi-layer heat transfer element having:
"a core spacer element having a top surface and a bottom surface;
a first layer of thermally conductive reflowable material formed on the top surface; and
a second layer of thermally conductive reflowable material formed on the bottom surface".

For one, the multi-layer heat transfer element is NOT arranged between the die 320 and the heatspreader 370 of *Chen* as asserted in the Action (See, *Chen* Fig. 7). Additionally, there is no core in *Chen*. The Action asserts that *Chen* element 332 is a core. The applicants respectfully disagree. *Chen* states (at 5:10-21) that element 332 is in fact an overhead portion of a heatspreader not a core between two thermal layers enabling thermal contact with a heat spreader. Additionally, there is no indication that a reflow material is used to attach the die to the heat spreader and core as required by the claims. The only indication of as to what these materials are is at *Chen* 4:23-49 and the later description of element 375 which indicate adhesive or conductive materials but do not teach reflow materials. Since solder (a reflow material) is discussed elsewhere in the *Chen* specification it is reasonable to expect that it would be disclosed as the adhesive element if that is what the inventors intended.

Thus, the aforementioned features effectively distinguish Claim 2 from the cited art. Moreover, the added Claims 29, et seq. make these structural relationships even more clear. Accordingly, for at least this reason, the applicants have shown that the cited art is missing certain claimed elements (i.e., the reflowable first and second layers, the lack of a multi-layer heat transfer element between the die and heat spreader, and so on) and is therefore insufficient to establish a *prima facie* case of anticipation relative to Claim 2. As a consequence, the applicants request that this ground of rejection be withdrawn and Claim 2 be allowed.

Moreover, as to dependent Claims 3-14, all of these claims are dependent on Claim 2. Each of these claims has separate grounds for allowance. However, due to the failure to establish a *prima facie* case of anticipation of base claim 2 it is not necessary to discuss the details of the dependent claims at this time.

Karnezos

Claims 1, 2, 4, 5, 7, 8, 10, and 11 are rejected under 35 U.S.C. § 102 as being anticipated by *Karnezos* (USPN 6,906,416 hereinafter "*Karnezos*"). As to Claim 1, this ground of rejection is made moot by the cancellation of Claim 1.

As to Claim 2, this claim has been amended to incorporate all limitations of Claim 1. The applicants point out that Claim 2 is distinct from *Chen* on several grounds.

For example, Claim 2 recites a "multi-layer heat transfer element arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader".

Also, Claim 2 recites a multi-layer heat transfer element having:

"a core spacer element having a top surface and a bottom surface;

a first layer of thermally conductive reflowable material formed on the top surface; and a second layer of thermally conductive reflowable material formed on the bottom surface”.

The following discussion highlights some of the distinctions between *Karnezos* and the cited art. For one, *Karnezos* does not include a multi-layer heat transfer element arranged between the die (e.g., 513) and the heatspreader 530 of *Karnezos* as asserted in the Action. For example, the Action asserts that elements 521, 512, 523 are a multi-layer heat transfer element. However, a closer review of *Karnezos* shows that this is not true. In *Karnezos* element 512 is a package substrate (See, *Karnezos* at 17:2-10) such as dies are commonly mounted on. The claimed invention has such a substrate (See, 101 of Fig. 2a, for example). Accordingly, element 512 is not a core configured for heat transfer as required by the claims. Additionally, there are no layers of reflowable material in *Karnezos*. The Action asserts that *Karnezos* elements 521 and 523 are just such reflowable layers. But, these are in fact standard patterned metallization layers that electrically connect to various elements on the die (See, *Karnezos* at 17:5-7). For such patterned metallization interconnects to be reflowable would be a disaster resulting in a non-functional device. As the traces melted and flowed during a reflow process, the trace patterns would flow and interconnect causing short circuits and misconnections making the device inoperative.

Thus, it is fairly clear that the cited art does not teach all of the required elements of Claim 2. Accordingly, because the applicants have shown that the cited art is missing certain claimed elements (i.e., the reflowable first and second layers, the lack of a multi-layer heat transfer element between the die and heat spreader, no core, and so on) the applicants believe that the cited art is insufficient to establish a *prima facie* case of anticipation relative to Claim 2. As a consequence, the applicants request that this ground of rejection be withdrawn and Claim 2 be allowed.

Moreover, as to dependent Claims 3-14, all of these claims are dependent on Claim 2. Each of these claims has separate grounds for allowance. However, due to the failure to establish a *prima facie* case of anticipation of base claim 2 it is not necessary to discuss the details of the dependent claims at this time.

Oman

Claims 1-3 and 10-12 are rejected under 35 U.S.C. § 102 as being anticipated by *Oman* (USPN 6,873,043 hereinafter “*Oman*”). As to Claim 1, this ground of rejection is made moot by the cancellation of Claim 1.

As to **Claim 2**, this claim has been amended to incorporate all limitations of Claim 1. The applicants point out that Claim 2 is distinct from *Oman* on several grounds. For example, Claim 2 recites a multi-layer heat transfer element having:

“a core spacer element having a top surface and a bottom surface;
a first layer of thermally conductive reflowable material formed on the top surface; and
a second layer of thermally conductive reflowable material formed on the bottom surface”.

This is different from *Oman* which does not teach a reflowable first and second layers. In the Action it is argued that elements 38 and 34 teach such reflowable layers. However, *Oman* teaches (for example, *Oman* at 4:15-20) that the contact layers 34, 38 are rectangular copper sheets. Such sheets are not solder or other reflow materials as is required by the claims. As a result, the *Oman* structure does not contain a multi-layer heat transfer element with reflowable materials surrounding a core. A consequence of this is that the *man* structure is too thick and too difficult to manufacture. Accordingly, this prior art is deficient for much the same reason as *Burman* discussed above.

Accordingly, for at least this reason, the applicants have shown that the cited art is missing certain claimed elements (i.e., the reflowable first and second layers) and is therefore insufficient to establish a *prima facie* case of anticipation relative to Claim 2. As a consequence, the applicants request that this ground of rejection be withdrawn and Claim 2 be allowed.

Moreover, as to dependent Claims 3-14, all of these claims are dependent on Claim 2. Each of these claims has separate grounds for allowance. However, due to the failure to establish a *prima facie* case of anticipation of base claim 2 it is not necessary to discuss the details of the dependent claims at this time.

Dyckman

Claims 1-4 and 9 are rejected under 35 U.S.C. § 102 as being anticipated by *Dyckman et al.* (USPN 6,657,864 hereinafter “*Dyckman*”). As to **Claim 1**, this ground of rejection is made moot by the cancellation of Claim 1.

As to **Claim 2**, this claim has been amended to incorporate all limitations of Claim 1. The applicants point out that Claim 2 is distinct from *Dyckman* on several grounds. For example, Claim 2 recites a multi-layer heat transfer element having:

“a core spacer element having a top surface and a bottom surface;
a first layer of thermally conductive reflowable material formed on the top surface; and

a second layer of thermally conductive reflowable material formed on the bottom surface”.

This is different from *Dyckman* which requires that, on either side of element 50, an elastomeric material 62, 63 be used to adhere the heatspreader 70 to a die 20 (See, *Dyckman* at 5:45-65; and elsewhere). In particular, the elastomeric layers 62 and 63 are not the same as the reflow materials taught by the present invention. Moreover, the *Dyckman* technology creates thick thermal layers between the die and heatspreader relative to the claimed invention thereby increasing overall package thickness. This prevents the cited art from being used in low profile compact device packages and hence is another undesirable attribute of the prior art.

Accordingly, for at least this reason, the applicants have shown that the cited art is missing certain claimed elements (i.e., the reflowable first and second layers) and is therefore insufficient to establish a *prima facie* case of anticipation relative to Claim 2. As a consequence, the applicants request that this ground of rejection be withdrawn and Claim 2 be allowed.

Moreover, as to dependent Claims 3-14, all of these claims are dependent on Claim 2. Each of these claims has separate grounds for allowance. However, due to the failure to establish a *prima facie* case of anticipation of base claim 2 it is not necessary to discuss the details of the dependent claims at this time.

Thus, for at least the reasons explained above, the applicants assert that the cited art fails to establish a *prima facie* case of anticipation as to Claims 2-14. Accordingly, the applicants request that the pending rejections be withdrawn.

New Claims 29-35

Claim 29 more clearly and descriptively articulates the relationship between the die, heatspreader, and multi-layer heat transfer element. Claims 30-35 are dependent on either Claims 2 or Claim 29 and highlight the advantageous feature of an extremely thin multi-layer heat transfer element which is not taught, suggested, or even possible in the cited art. All of these limitations are believed to further define over the cited art.

Conclusion:

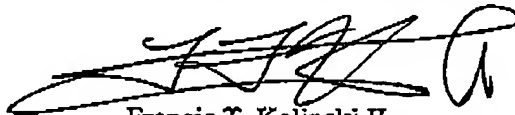
In view of the foregoing amendments and remarks, it is respectfully submitted that the claimed invention as presently presented is patentable over the art of record and that this case is now in condition for allowance.

Accordingly, the applicants request withdrawal of all pending rejections and request reconsideration of the pending application and prompt passage to issuance. As an aside, the applicants clarify that any lack of response to any of the issues raised by the Examiner is not an admission by the applicant as to the accuracy of the Examiner's assertions with respect to such issues. Accordingly, applicant's specifically reserve the right to respond to such issues at a later time during the prosecution of the present application, should such a need arise.

As always, the Examiner is cordially invited to telephone the applicants representative to discuss any matters pertaining to this case. Should the Examiner wish to contact the undersigned for any reason, the telephone numbers set out below can be used.

Respectfully submitted,

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